# PREBAKED CARBON ELECTRODE FROM INDONESIA GREEN PETROLEUM COKE

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## Introduction

Green petroleum coke was produced by Dumai Oil Refinery in Indonesia. This materials was considered less value compare to calcined coke. To increase its added value, the green coke has been used for prebaked carbon electrode. We investigate the influence of baking temperature and binder contents to properties of prebaked electrode namely : electrical resistivity, strength, young's modulus, and coefficient of thermal expansion (CTE). This investigation enable us to select appropiate basic materials for carbon electrode production.

## Experimental

***Petroleum Coke Preparation***

The green petroleum coke was subjected to a step-wise grinding and sieving technique to reduce its particle size to -6 - 200 mesh (Tyler). Binder coal tar pitch was also reduced its particle size to -28 mesh. Afterward both were used as feedstock for prebaked anode.

***Molding Process***

Green petroleum coke and coal tar pitch were mixed in a mixer and subjected to heat at 160°C for $^1/_2$ h. The mixed feedstock was stirred during heating and the obtained paste then molded at 130°C and pressure 50 kg/cm$^2$ with size H x Q = 120 mm x 40 mm.

***Prebaked Anode Production***

The molded mixture was then undergo baking process in a furnace. The processing steps used to produce the prebaked anode namely at 900°C, 1100°C and 1300°C and presented in the following table :

Prebaked Anode at 900°C

| Heating range, °C | Heating rate, °C/min | Time, h |
|---|---|---|
| Ambient temp. - 200 | 1 | |
| 200 - 600 | 3 | |
| 600 - 900 | 7 | |
| 900 | hold | 3 |

Prebaked Anode at 1100°C

| Heating range, °C | Heating rate, °C/min | Time, h |
|---|---|---|
| Ambient temp. - 200 | 1 | |
| 200 - 600 | 3 | |
| 600 - 1100 | 7 | |
| 1100 | hold | 3 |

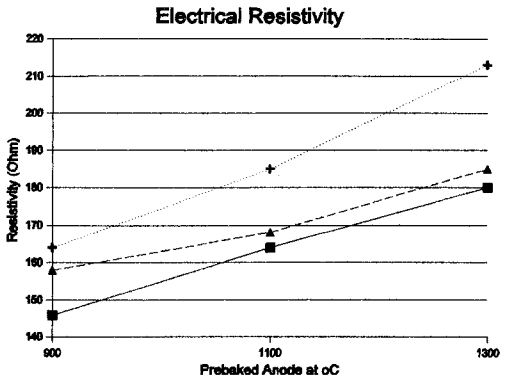
Prebaked Anode at 1300°C

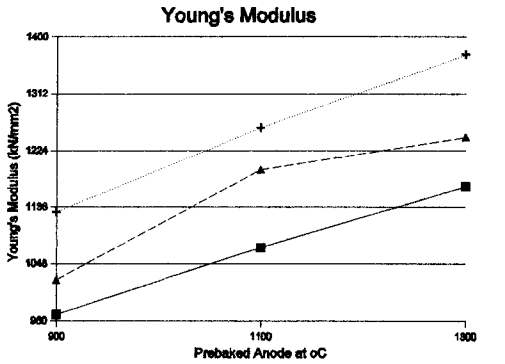
| Heating range, °C | Heating rate, °C/min | Time, h |
|---|---|---|
| Ambient temp. - 200 | 1 | |
| 200 - 600 | 3 | |
| 600 - 1300 | 7 | |
| 1300 | hold | 3 |

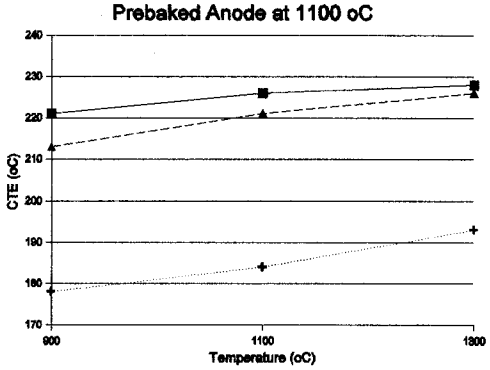
## Results and Discussion

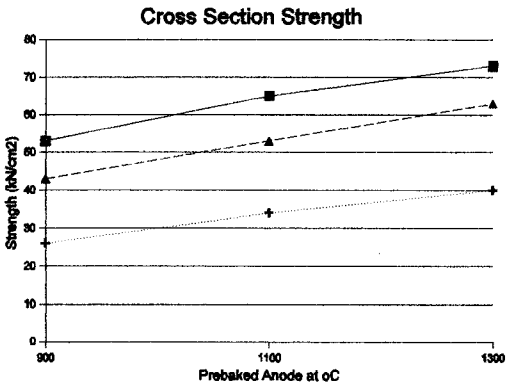
The purpose of binder materials is to wet the surface of carbon grains, give mixtures of high plasticity when mixed with grains and give high yield carbon residue after pyrolysis. During baking process, volatile products are generated which must be removed from the carbon.

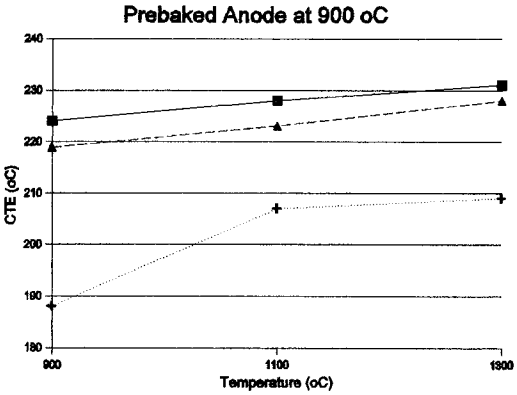
Heat transfer and the diffusion of the volatile products are influenced by layers of packing material, needed to prevent deformation of the bodies at temperatures between the softening point of the binder and binder coke formation. The packing materials also protects the bodies against oxidation. The bodies also undergo complicated volume changes during baking which depend on the type and amount of the binder, the heating rate and the volume of the body. These changes, as well as pore formation, require certain heating program and it can be seen in the table in order to avoid crack formation which is detrimental to the quality of the products. The increasing amount of binder and baking temperatures tend to increase the electrical resistivity and young modulus. Both can be seen in figures. Electrical resistivity was influenced by green coke purity, structure and porosity. Calcined petroleum coke is preferrable as the volatile matters were greatly reduced and result to low the electrical resistivity. The binder plays an important role in the development of mechanical properties of prebaked anode. The higher amount of binders will contain higher QI and it'll increase the chemical reactivity and allow to increase

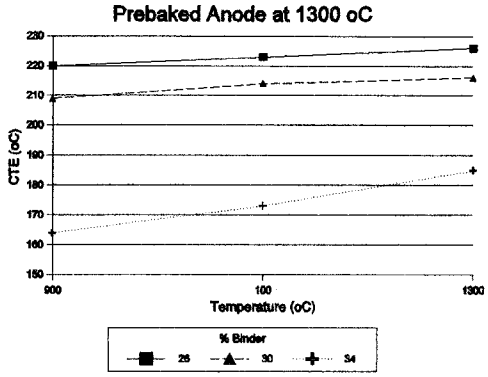



pore formation within carbon materials. So, the cross section strength tends to decrease with increasing binder percentage. Higher experience temperature will increase CTE units as a result of increasing amount of pore formation and conversely higher binder content tends to decrease CTE value due to formation of interlocking process between carbon molecules.

## Conclusions

Higher content of binder and heat treatment temperature given wil increase electrical resistivity and young's modulus. The strength and CTE value are increasing due to higher heat treatment temperature, but binder contents tend to reduce CTE and strength. Calcined petroleum coke is preferable raw materials for carbon anode production.

## References

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